PRICE $1.50

INSTRUCTION MANUAL

MAXI-TUNE

IGNITION ANALYZER

This precision analyzer combines the most important functions and measurements necessary for a complete tune-up on any engine. Its six test positions allow you to make over 15 basic professional tune-up tests including low (idle) and high RPM, point condition, dwell, dwell variation, idle mixture, power balance, mechanical advance, alternator output, regulator voltage, cranking voltage and air cleaner test.

SPECIFICATIONS – Dual range tachometer, high range 0-6000 RPM, low range 0-1600 RPM ■ Expanded dwell scales 8 cylinder, 15° to 45°, 6 cylinder 20° to 60° , 4 cylinder, double 8 cylinder scale, 30° to 90° ■ Voltmeter range 0-16 volts ■ Ammeter –5 to +80 amps ■ Points test, OK – BAD – OPEN ■ Tests 4, 6, 8 cylinder and rotary (Wankel) engines ■ For conventional, breakerless and electronic ignitions, transistorized and C.D. ignition systems ■ Works on 12 volt positive or negative ground vehicles ■ Extra large, easy-to-read 4" meter ■ D'Arsonval movement ■ No calibration required ■ Complete with heavy duty test leads and external shunt.

SIZE: Unit measures 7-1/2" long x 5" wide x 2-1/2" deep ■ Color coded dial is protected by a non-yellowing crystal clear lens ■ High impact molded case with custom swivel handle allows 3 way use, hand held, hanging or stand up on handle ■ Solid brushed aluminum face plate.

RAC

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PRINTED IN U.S.A.

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The index is laid out by test and tune subjects for your convenience in locating instructions for a specific test or service operation with your analyzer.

General Instructions

This analyzer has been designed to provide you with the professional capability to evaluate any engine's condition and to do all the necessary adjustments and tests required during a tune-up. The unit has been factory calibrated and exceeds the car manufacturers' specifications for accuracy of testing equipment. It requires no "in-use" re-calibration or setting and its solid state circuitry does not use an internal battery. The circuitry provides accurate RPM and dwell readings even with "bad condition" ignition points, open or shorted sparkplug wires. A pointer zero adjustment allows resetting the meter to its 0 position for long life accuracy.

This instruction manual explains in practical, do-it-yourself terms, how to use your analyzer to do a professional job. The analyzer will work on any 12 volt, positive or negative ground, 4, 6, 8 cylinder or rotary (Wankel) engine with conventional breakerless electronic ignitions, transistorized and capacitive discharge (CD) type ignition systems. A step-by-step guide to doing a basic tune-up is included along with complete instructions on how to use your analyzer to pinpoint many electrical system problems.

ZERO ADJUST

Before using your analyzer always check that the meter reads on zero without any of the leads connected to the vehicle. If it doesn't, use a small screwdriver to turn the zero adjuster in the opening on the front of the meter left or right slightly until the meter rests on zero. This adjustment assures you the maximum accuracy that was built into your analyzer's circuit. While zeroing your meter, always hold the meter, while zeroing it, in the position it will be used while making RPM, dwell and points condition, volts and amps tests.

READING IF UPRIGHT

ZERO IN THIS POSITION

READING IF IN THIS POSITION

ZERO IN THIS POSITION

CONTROLS

The function is selected by a six position switch. The six positions are Points, Dwell, Lo RPM, Hi RPM, Volts, Amps. This switch is programmed so you can quickly test a vehicle following a logical testing procedure by turning the switch in one direction. This eliminates the need to flip back and forth from position to position as you make your tests or adjustments.

The cylinder selector switch is used to select the proper internal circuitry for 4, 6 or 8 cylinder engines. Refer to the Testing Rotary (Wankel) engine section when setting your analyzer's controls for this type of engine.

TESTING ROTARY (WANKEL) ENGINES

This instrument may be used on rotary (Wankel) engines with conventional, breakerless and electronic ignitions, transistorized and CD type ignition systems. The design of this type engine provides for one spark plug firing per crankshaft revolution. To read correct RPM and Dwell refer to the following table:

Number of rotors	2	3	4
Read RPM and Dwell on scale for conventional engines with:	4 cyl.	6 cyl.	8 cyl.

The points function tests are read in the same manner as conventional type engines.

Test Functions

(See Figure 1)

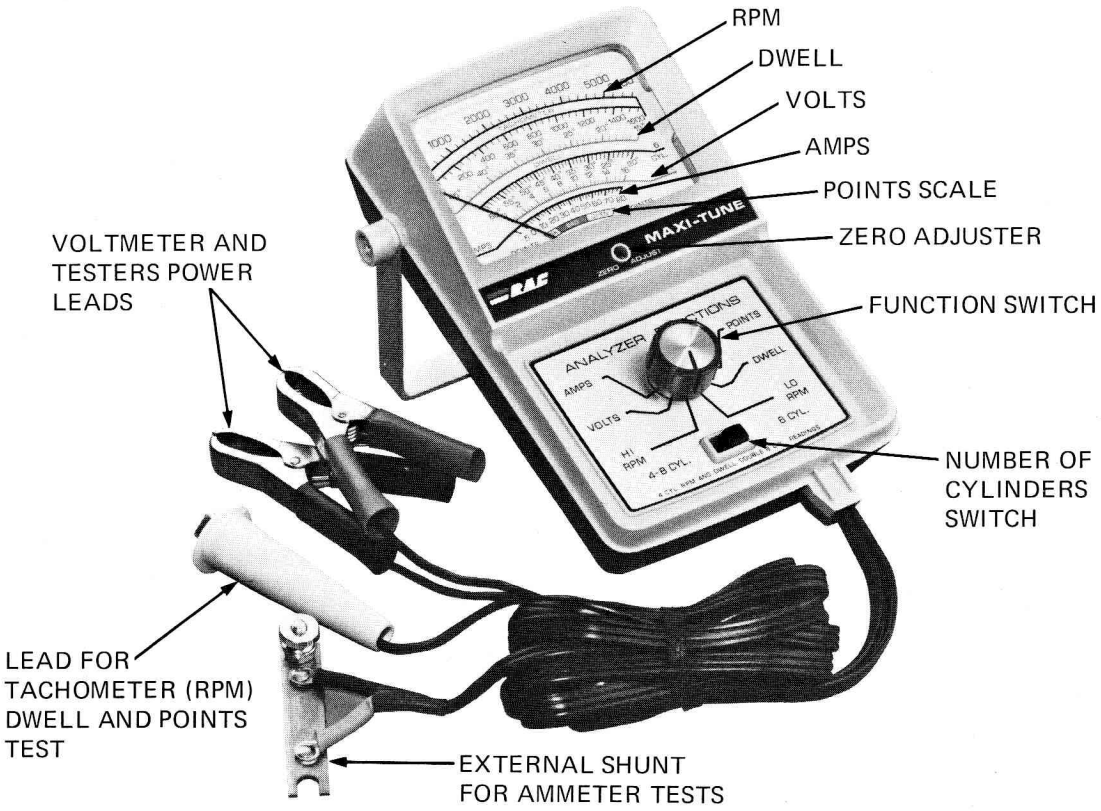
TACHOMETER

The dual range tachometer covers idle, fast idle and the high speed operating ranges of your vehicle. Low RPM covers 0 to 1600 RPM with 50 RPM divisions. This range is used for idle speed mixture adjustments and timing RPM settings, adjusting emission controls and testing cylinder power balance. The Hi RPM range, 0 to 6000, with 200 RPM divisions is used for testing at higher RPMs.

DWELLMETER

Unique expanded dwell scales for direct reading on 8 cylinder, 15^{o} to 45^{o} and 6 cylinder 20^{o} to 60^{o} both with 1^{o} divisions provide for extreme reading accuracy in this critical setting. Four cylinder and rotary (Wankel) engines are measured by doubling the readings on these two expanded scales.

Figure 1



VOLTMETER

The 0 to 16 volt scale with 0.5 volt divisions is used to test the battery's cranking voltage, the charging systems regulated voltage and all trouble shooting tests of the electrical system.

AMMETER

The ammeter's external shunt makes charging system output tests easy to read on the -5 to +80 amp scale. The scale is divided into 2.5 amp divisions. The ammeter also may be used to measure the current draw of accessories.

POINTS

This three position scale OK – BAD – OPEN is used to determine the condition of the ignition points without removing the distributor cap.

LEADS

One set of color coded insulated clip leads are used for the Points, Dwell, RPM and Volts tests. A second lead set with an external amp shunt is used for the ammeter tests.

CASE AND HANDLE

The case is made of a high impact material with a brushed aluminum face plate. The custom swivel handle may be used to hang up the tester or support it at a convenient viewing angle.

CARING FOR YOUR ANALYZER

Your analyzer is constructed of unbreakable and stain proof materials to give you years of maintenance free service. The meter face is treated with an anti-static solution. To renew this solution, occasionally wipe the meter face with a soft cloth dampened in a solution of 10 parts water to 1 part detergent. This same solution may be used to clean off grease or dirt on the instrument case or leads. Extremely soiled test leads may be cleaned with a waterless type handsoap. Do not use gasoline, thinner or any other solvent to clean the lens or case.

Basic Hookups

POINTS, DWELL AND RPM TESTS (Figure 2)

"Conventional Ignition Systems"

1. For negative ground vehicles; all points, dwell and tach (RPM) tests; connect the YELLOW lead to the distributor terminal of the ignition coil and the RED and BLACK leads to the battery's terminal, RED to (+) and BLACK to (–).
2. For positive ground vehicles, different connections are required for tach (RPM) readings and points dwell readings:

   a) For RPM (positive ground only): connect the RED lead to the distributor terminal of the ignition coil and the YELLOW and BLACK leads to the battery's terminals, BLACK to (–) and YELLOW to (+).

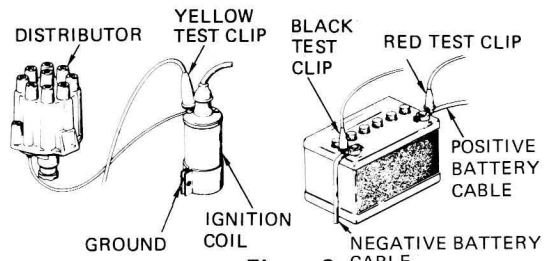


Figure 2

   b) For points, dwell (positive ground only) connect the BLACK lead to the distributor terminal of the ignition coil and the YELLOW lead to either the battery's (+) terminal or, alternately, a good chassis ground, such as any bolt or nut on the engine. DO NOT CONNECT RED LEAD TO ANYTHING.

"Breakerless and Electronic System and Transistorized and C.D. Ignition Systems"

1. Connect RED and BLACK leads to the battery's terminal, RED to (+) and BLACK to (–).
2. Breakerless and Electronic Ignition Systems:

   a) GM V8 cylinder (Delco) System - Connect YELLOW lead to the "Tach" terminal on the distributor.

   b) GM 4 and 6 cylinder systems, all Ford, Chrysler and most aftermarket add-on systems - Connect YELLOW lead to the coil's distributor (–) or DEC (on Ford) terminals.

   c) Some other systems may have a special terminal identified as "TACHOMETER." These may be on the distributor as on the GM V8 system or on a separate electronic package. Connect your YELLOW lead here for RPM readings.

VOLTMETER TESTS (Figure 3)

Connect the RED and BLACK clip leads to the battery or circuit being tested observing correct polarity RED to + BLACK to –.

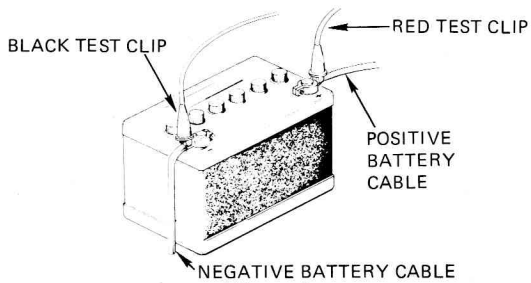


Figure 3

AMMETER TEST (Figure 4)

Remove the wire from the output (B+) terminal from the alternator or generator. Connect one end of the shunt to this terminal and the wire to the other end. When using the shunt on positive ground systems or if the meter reads off scale to the left, move the knurled nut assembly to the other end of the shunt and reverse its connection in the circuit.

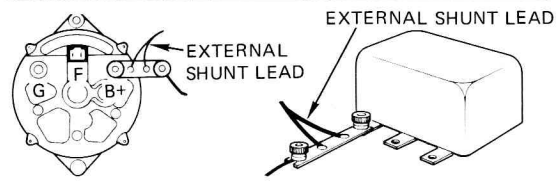


Figure 4

ALTERNATE CONNECTION POINT

Connect shunt to point where output (B+) lead connects in the vehicles wiring harness. Examples; at horn relay, or starter solenoid.

CAUTION: Make all ammeter connections with engine stopped. Do not allow the shunt to contact any grounded surfaces while making the connections or during the tests.

Using Your Analyzer For Tune-Ups

A tune-up is defined as the steps you must do to return an engine to as close as possible to an as-new condition so that your vehicle performs to your satisfaction. Your analyzer can help you perform many of these steps, quickly and accurately. You can also use it to pinpoint problem areas uncovered during your tune-up. In order to help you select those tests that most quickly and thoroughly do the job during a tune-up, they are printed in a bolder type in the operating instructions of this manual. The lighter type face covers the pinpoint tests you can do with your analyzer.

This analyzer tests the ignition system, starting and charging systems and the battery. During a tune-up you'll also need a timing light and a compression tester. Other RAC products that are useful are: a remote starter switch, vacuum and fuel pump tester, combustion efficiency tester and a tune-up guide.

The Basic Outline for a Tune-Up Is:

		Test Equipment Used
1.	Check the compression	Compression Tester
2.	Clean all fuel, air and oil filters	Service Operation
3.	Check carburetor and choke linkage	Service Operation
4.	Test and service PCV System	Tachometer
5.	Inspect spark plug wires	Service Operation
6.	Clean or replace spark plugs	Service Operation
7.	Replace ignition points and condenser	Service Operation
8.	Set dwell and check dwell variation	Dwellmeter
9.	Set initial timing at correct RPM	Timing light and Tachometer
10.	Set idle speed	Tachometer
11.	Set idle mixture	Tachometer
12.	Test cylinder power balance	Tachometer
13.	Test battery and starting system	Voltmeter
14.	Test charging system	Ammeter, Voltmeter
15.	Road test for proper operation	

Using Your Analyzer For Testing

You may use your analyzer to test an engine by following the basic tune-up tests listed in this manual without doing any of the service operations. This way you determine what service is required and what parts will be necessary before you start the tune-up. For example, you can use this procedure to test a used car, determine how much work is required to smooth out a rough running engine or determine if your car is ready for a long trip. Test by following the instructions in the bold type.

Using Your Analyzer To Pinpoint A Problem

Your analyzer is a valuable tool in determining exactly what components require adjustment, service or replacement. As you uncover a problem area during your tune-up testing, the instructions will suggest a pinpoint test that will help you find the exact cause. These tests in the lighter type need only be done if you are looking for the problem listed. One of the secrets of doing professional quality work is to know how to quickly test an engine with the minimum number of tests that will uncover the maximum number of problems. Then knowing how to test to pinpoint the problems. This manual will help you to do a more professional job with your analyzer.

Tests

ALL tests are run with the engine at normal operating temperatures unless stated otherwise.

Points Tests

This position tests for excessive resistance in the ignition points which will directly affect the operation of the ignition system causing hard starting, missing and poor gasoline mileage. This test not required on breakerless ignition systems.

1. Connect leads for Points Dwell, RPM test. Figure 2.
2. Place selector in Points position.
3. Turn the vehicles ignition switch on.
4. If the meter reads in the White OPEN band, operate the starter to bump the engine over until the points close and the meter reads in either the White OK or Red BAD band.
5. Read the meter:

ACCEPTABLE – Meter reads in OK band

Proceed to Dwell test

NEEDS SERVICE – Meter reads in BAD band

CORRECTIVE ACTION – Inspect ignition points. Clean surface by filing or replace the ignition points.

Helpful Hints: Always replace pitted or blued (overheated) points and install a new condenser.

Dwell

The Dwell angle is the time the points remain closed during the ignition cycle. Proper dwell allows the full buildup of energy in the ignition coil for a good spark at all engine speeds. Excessive dwell results in point burning and rapid deterioration, while too little dwell reduces the available spark voltage resulting in poor acceleration and missing at higher RPM. Always test and adjust the dwell angle after either cleaning or replacing the ignition points and before adjusting timing. Any change in the dwell angle will cause an equal amount of change in degrees in the ignition timing.

Vehicles with breakerless ignitions do not have a conventional dwell period. The electronic circuitry controls the "on time" of the ignition coil and when measured with a dwellmeter, the indicated dwell varies with engine RPM. For this reason the car manufacturers do not specify a dwell setting. You do not have to make the following dwell tests if your car has a breakerless ignition system.

TESTING AND ADJUSTING DWELL

Refer to manufacturers' specifications for the correct dwell angle specification.

1. Set the selector switch to the DWELL position and connect the leads for Points, Dwell, RPM Test. Figure 2.
2. Set cylinder selector switch to correct position for your car.

NOTE: Double the 8 cylinder reading for 4 cylinder engines.

3. To test dwell, read the proper dwell scale while the engine is at idle RPM.
4. To set or readjust dwell:

   Delco window type distributors
   a. Operate the engine at idle RPM
   b. Lift the window and use a tool to turn the adjuster until the proper dwell setting is obtained.

   Other types of distributors with single ignition points.
   a. Remove distributor's cap and rotor.
   b. Loosen the ignition points' hold-down screws.
   c. Crank engine and turn the adjuster until the proper dwell setting is obtained.
   d. Tighten hold-down screws and recheck dwell.

Helpful Hints: When the manufacturers specification is given as a range (example 28^{o}–32^{o}) set the dwell toward the lower value to allow for normal wear. Always align ignition points by bending the stationary contact until the point surfaces are parallel. Remove any burrs or molding ridges from the rubbing block's wear surface as these imperfections will wear off quickly in use and upset your dwell reading. If you note a timing change several days after a tune-up, always check dwell first to be sure it was not caused by a change in dwell.

DUAL POINT DISTRIBUTORS

Two types of dual point installations are in use. One has two individual points, each independently controlling the coil. The other type uses two sets of ignition points in parallel to extend the total dwell period. To identify: the first type will have a distributor cam with only half the distributor cam lobes as there are cylinders. The second type will have the same number of distributor cam lobes as cylinders. To adjust either type: always block

open one set of points with a clean piece of smooth card stock while adjusting the other set. After setting one set, remove the card stock and move it to the other set and adjust remaining point set. Some emission controlled engines have a separate control circuit to cut-in or out the second set of points. Refer to manufacturers manual for proper method of setting these points. On vehicles with the points in parallel, after setting the point dwell for each set, check that the total dwell is also within manufacturers specification, by removing the card stock and measuring the total dwell.

TESTING FOR DWELL VARIATION

Dwell variation (a change in the dwell reading as engine speed is increased) is caused by wear in the distributor shaft's breaker plate bearings, or a bent distributor shaft.

1. Increase engine speed to about 1,500 RPM.
2. Watch the dwell meter.

ACCEPTABLE – Dwell varied less than 3° or less than amount specified by manufacturer. Some manufacturers specify 5-7° as acceptable.

NEEDS SERVICE – Dwell variation larger than specified.

CORRECTIVE ACTION – Check distributor plate and bearings for wear. Excessive variation may also be caused by worn linkage in vacuum or mechanical advance mechanisms.

Helpful Hints: On distributor where breaker plate assembly pivots around distributor shaft, check bearing surface of breaker plate and shaft and for looseness in vacuum advance linkage. On distributor with off-center pivots, which normally have high dwell variations specified, check also for binding or wear of bearing points between breaker plate and bottom plate of distributor.

Tachometer

The tachometer is used to measure engine RPM. It is used while making idle speed and mixture settings. The tachometer also may be used to make tests of the PCV system, cylinder power balance, carburetor's air fuel ratio setting, air cleaner efficiency and the distributor's mechanical advance system.

IDLE SPEED AND MIXTURE SETTING

1. Set the selector switch to the Lo RPM position and set the cylinder selector switch to the correct position for your car. Connect the leads for the Points, Dwell RPM Test. Figure 2.
2. Adjust the idle speed screw on a fully warmed up engine until the engine is at the manufacturer's specified idle RPM. While following steps 3 and 4 of this procedure, readjust the idle speed as necessary to hold engine speed within 50 RPM of the specified idle RPM.
3. Turn the idle mixture screw in until the engine RPM slows. Then back out until engine reaches highest RPM. This is the proper idle mixture setting for pre-emission controlled vehicles.
4. On engines with emission controls: Do not remove idle mixture plastic caps if fitted. On all vehicles manufactured since 1968 (1966 in California) after completing step 3, turn idle mixture screw in (clockwise) until engine speed drops 50 RPM or the amount specified by manufacturer.

NOTE: On two or four barrel carburetors adjust each mixture screw individually following steps 3 and 4.

5. Follow the manufacturer's procedures for setting final hot idle speed, i.e. transmission in drive, air conditioner on, head lights on, etc. Set idle speed adjustment to manufacturer's specified idle RPM.

Helpful Hints: It is essential for good overall performance that the engine's compression be good, the ignition points and timing be set correctly and that the secondary ignition system, spark plugs, wires, etc. be in good condition before starting to set mixture. Follow manufacturer's recommendations when setting idle mixture, especially with emission controlled vehicles.

PCV TEST

This test checks the operation of the PCV system.

1. Set the engine at idle RPM.
2. Remove the PCV hose from the valve cover. Leave the other end connected to the intake manifold.
3. Close off the end of the PCV hose with your finger. Note RPM.

NOTE: If the PCV valve cannot be easily removed this test may also be run by pinching closed the PCV hose at any point.

ACCEPTABLE – If PCV system is functioning properly the engine should slow down a minimum of 50 RPM.

NEEDS SERVICE – If the engine does not slow down at least 50 RPM, replace PCV valve and clean out PCV hose.

CYLINDER POWER BALANCE

This test determines if each cylinder of the engine is producing equal power. Unequal power indicates problems in the ignition, compression or fuel system. This test may be run before a tune-up to determine which cylinders have problems, or afterwards to check if any individual cylinders have a problem which you missed.

1. **Set the engine speed to any steady speed between idle and 1,200 RPM. Be sure the engine is at its normal operating temperature.**
2. **One by one remove, and reconnect each spark plug wire. As each wire is removed the RPM will decrease. Record the RPM for each cylinder while the spark plug wire is removed.**
3. **Compare these RPM readings:**

ACCEPTABLE – If all readings are within 50 RPM of each other the engine has equal power output from each cylinder. This indicates that no unusual problems exist in any one cylinder's ignition, compression or fuel system.

NEEDS SERVICE – If one or more cylinder is more than 50 RPM different than the others, check those with the highest RPM. They have ignition, compression or fuel system problems that are causing those cylinders to produce less power than the others.

NOTE: On some late model (1971 and later cars) with exhaust gas recirculating type emission controls, this test will give erroneous results. Some "good condition" cylinders will show no decrease or an increase in speed.

OTHER TESTS WITH TACHOMETER

IDLE MIXTURE TEST

1. Remove the air cleaner.
2. Be sure the engine is fully warmed up, the choke is fully open and engine is at correct idle RPM.
3. Slide a flat plate slowly over the carburetor's air horn to block off air flow.
   a. If the engine speed increases the idle mixture is too lean.
   b. If the engine speed decreases idle mixture is too rich.
   c. Little or no change in speed as the air horn is almost completely closed off indicates the mixture is acceptable.

AIR FILTER TEST

This test checks the condition of the air filter to determine if it is causing a reduction of air flow due to dirt or damage.

1. Remove the air cleaner cover and filter
2. Note RPM.
3. Replace air filter and tighten cover securely. If engine speed decreases, inspect air filter for excessive dirt or damage which may restrict air flow.

DISTRIBUTOR MECHANICAL ADVANCE TEST

This test determines if the distributor's mechanical advance mechanism is working.

1. Set the engine to the lowest idling speed possible.
2. Loosen the distributor and rotate it slightly until the engine runs at the highest RPM. Hold distributor in this position.
3. Increase the engine speed to approximately 1,000 RPM and hold this throttle setting.
4. Rotate distributor again and note maximum increase in RPM. If the engine speed increases more than 100 RPM the mechanical advance mechanism is not working properly and the distributor should be removed and the mechanism checked for binding, wear or damage.
5. Return the engine speed to the correct idle RPM and reset the initial timing to factory specifications.

NOTE: Do not attempt to set initial timing by "peaking" RPM while turning distributor. On late model, emission controlled vehicles this may lead to overheating, dieseling and possible engine damage.

Voltmeter

The Voltmeter is used during a tune-up to measure battery voltage while cranking and the charging system voltage while running – other uses include measuring voltage at various points in any circuit or determining the points of excessive resistance in a circuit.

Tune-up tests with the Voltmeter

BATTERY VOLTAGE WHILE CRANKING – This test determines if the battery is fully charged and if there are any problems in the starter, starter solenoid or battery cables.

1. **Set the function switch to volts and connect the leads to the battery's terminals (Figure 3).**

2. Remove the coil's high tension lead from distributor cap and ground it. This prevents the engine from starting.

3. Crank the engine for 15 seconds and read the voltmeter.

ACCEPTABLE – Voltmeter reads above 10.5 volts. No service required.

MARGINAL – Voltmeter reads between 9.6 and 10.5 volts. Check battery specific gravity. Recharge if low.

NEEDS SERVICE – Voltmeter reads below 9.6 volts.

CORRECTIVE ACTION – First test the battery's state of charge and recharge as necessary. A low battery may be due to: internal defect in battery, malfunctioning charging system due to low output or incorrect voltage, defective starter, excessive circuit resistance in starter solenoid or battery cables. Test each item individually.

CHARGING SYSTEM VOLTAGE – This test determines if alternator or generator and voltage regulator are working properly.

1. Set function switch to volts and connect the leads to the battery's terminals. (Figure 3).

2. Start the engine and run at a fast idle (2000 RPM) for 10 minutes. If vehicle has an ammeter run until charging current is 10 amps or less. Read voltmeter.

ACCEPTABLE – Voltage is between 13.5 and 15.3 or at the charging voltage specified by manufacturer.

NEEDS SERVICE – Voltage is not within specified voltage range. If it's too low the voltage regulator may set too low or the alternator or generator is defective. If it's too high the voltage regulator is set too high or is defective. On some vehicles, circuit resistance in the charging system can also result in too high a voltage reading.

CORRECTIVE ACTION – Test voltage regulator setting following test procedure for Precision test of the regulator's voltage setting.

OTHER TESTS WITH THE VOLTMETER

VOLTAGE TESTS – This meter may be used to measure the voltage supplied to any electrical circuit or the voltage in any part of the circuit.

1. Set function switch to volts.

2. Connect leads; RED to positive side of circuit BLACK to negative.

3. Turn that circuit being tested ON and read voltmeter.

ACCEPTABLE – Voltage within .5 of battery voltage or as specified by manufacturer.

NEEDS SERVICE – If the voltage is low.

CORRECTIVE ACTION – Follow circuit resistance test procedures to pinpoint problem areas.

CIRCUIT RESISTANCE – The voltmeter may be used to detect excessive circuit resistance which causes an unwanted voltage drop in a circuit. Circuit resistance may be in either the insulated circuit or the ground circuit.

INSULATED CIRCUIT TESTS

1. Set function switch to volts.

2. Connect leads: Circuit resistance in starters insulated circuit. Figure 5. Circuit resistance in charging system insulated circuit. Figure 6.

3. Operate circuit being tested. Read voltmeter.

ACCEPTABLE – Voltmeter reads close to 0 volts indicating no voltage drop occurs in circuit. Maximum allowable voltage drop is 0.5 per connection point or length of wire. There should be no voltage drop across a switch or relay contacts.

NEEDS SERVICE – If meter reads above 0 while circuit is operating, pinpoint the resistance by moving the BLACK lead to next connection point in circuit toward the battery. If reading does not change then the position of circuit between this test point and first test point is OK. Continue to move BLACK lead toward battery until reading changes. The last section tested has the excessive resistance.

CORRECTIVE ACTION – Clean connections and replace worn or frayed leads. If circuit resistance is in a switch or control replace it.

NOTE: Circuit resistance tests may be made in the ground circuit in a similar manner. See Figures 7 and 8.

Precision test of the regulator voltage setting

This test is used for critical testing or during re-adjusting of the regulator voltage control point. During this test be sure your battery is fully charged or that the output of the charging system is less than 10 amps at 2000 RPM.

1. Install a fully charged battery in the vehicle or; connect the ammeter shunt and run engine at

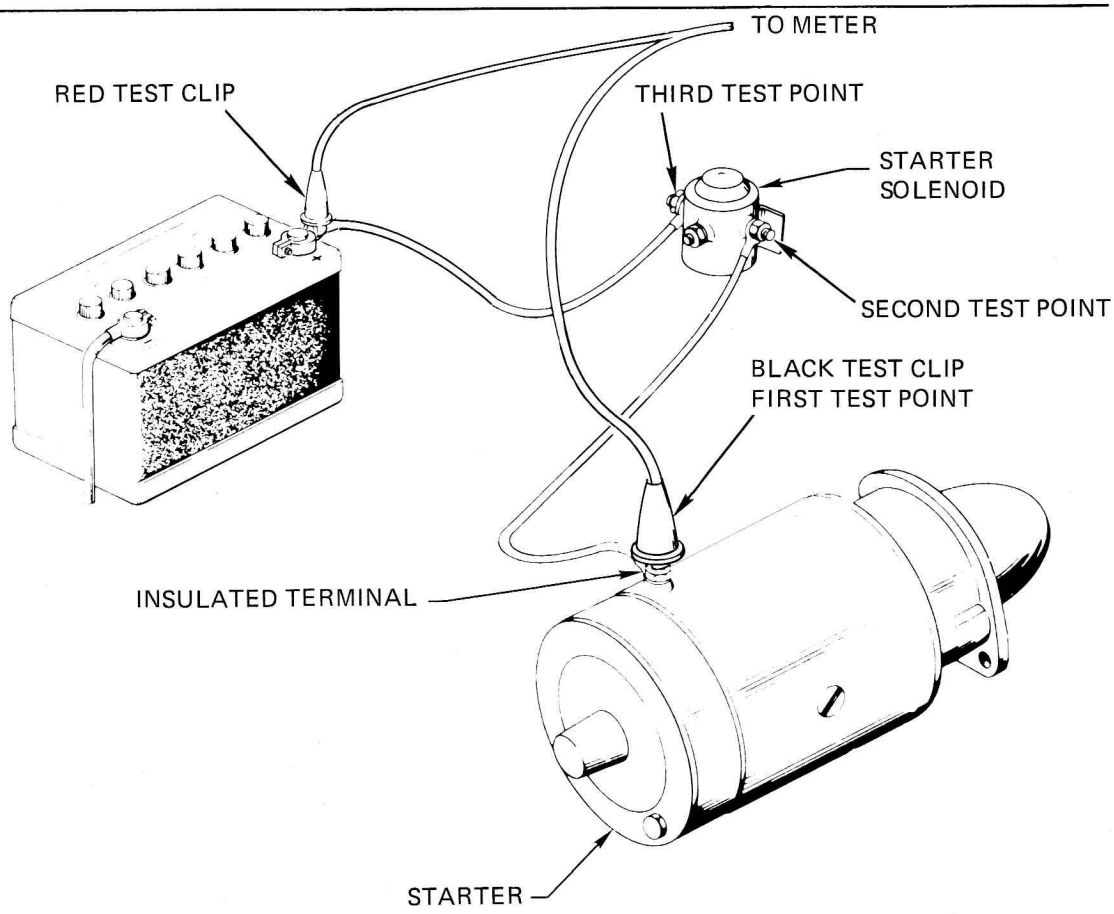


Figure 5 – Circuit Resistance In Starters Insulated Circuit.

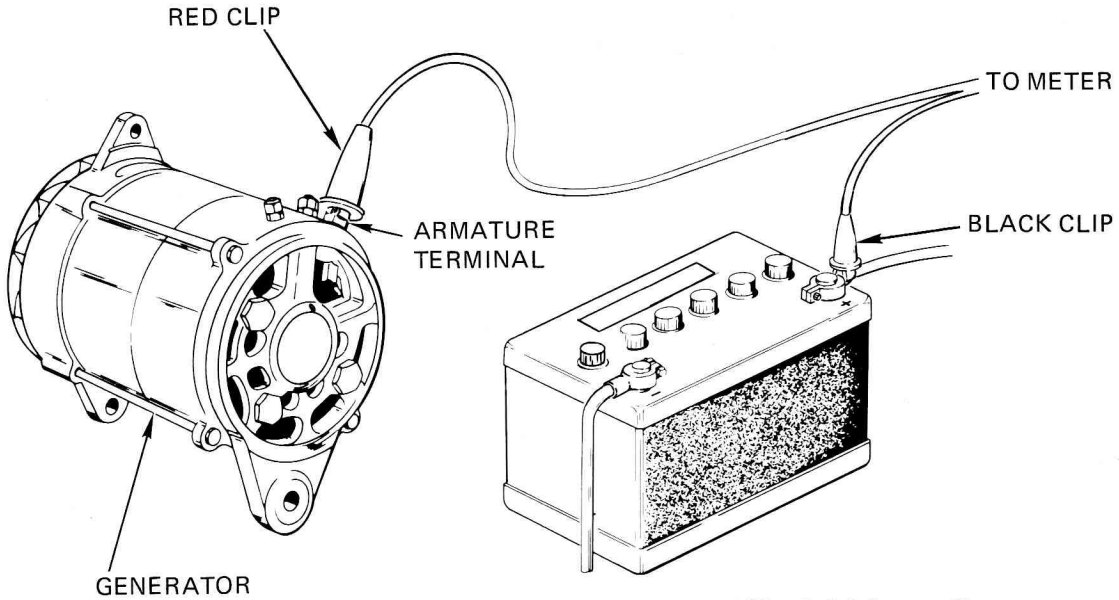


Figure 6 – Circuit Resistance In Charging System Insulated Circuit.DC System Shown, Connections To Alternator Are Similar.

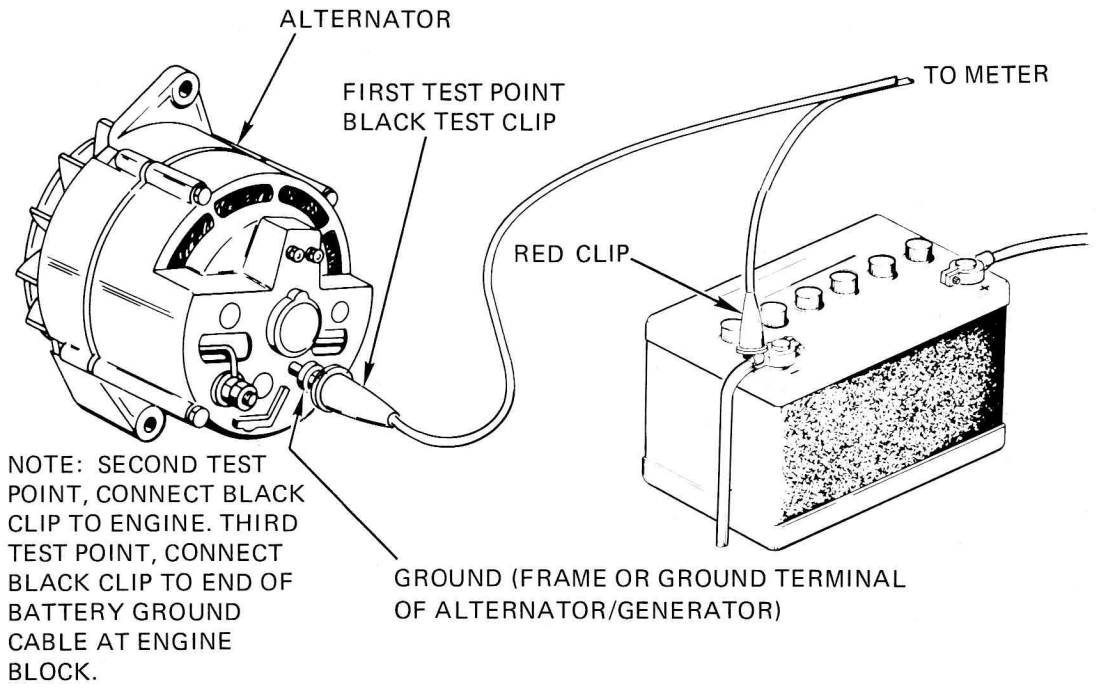


Figure 7 – Circuit Resistance in Charging System Ground Circuit

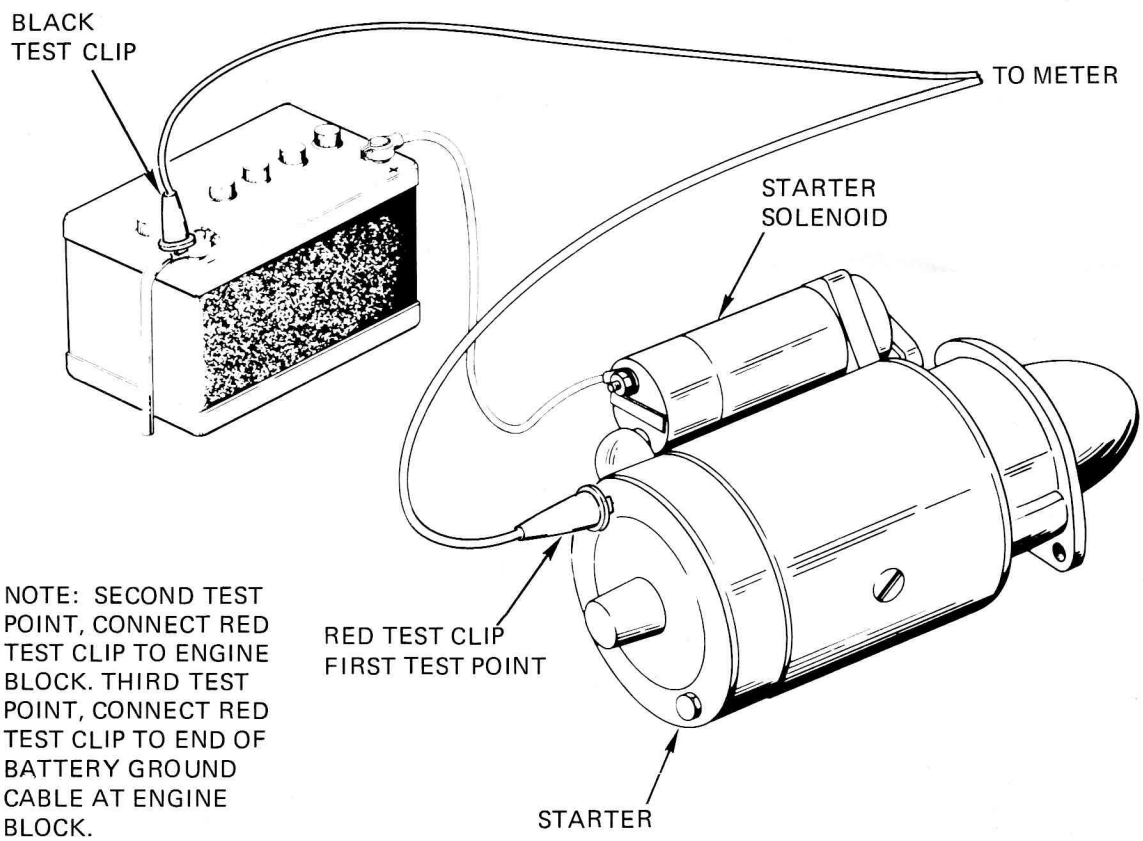


Figure 8 – Circuit Resistance in Starters Ground Circuit

2000 RPM. If output is 10 amps or less then continue test. If higher, recharge battery.

2. Connect the voltmeter leads to the battery. Figure 3.
3. Start the engine and run it at about 2000 RPM. Turn off all accessories and close doors.

ACCEPTABLE – Voltmeter reading is within manufacturers specifications for the regulated voltage. If specifications are unknown the following table may be used.

Temperature at Regulator	Battery Fully Charged
Cold – 40°F	13.9 to 14.5
Moderate – 70°F	13.7 to 14.3
Hot – 100°F	13.5 to 14.1

NEEDS SERVICE – If the voltage is too high or too low.

CORRECTIVE ACTION – Too high a voltage may be due to the setting of the regulator, circuit resistance in the wires and at connections between the battery and regulator, poor ground connections between the regulator, alternator or generator and the vehicle's chassis. Make the circuit resistance tests necessary to pinpoint the problem. Too low a voltage may be due to the setting of the regulator or due to a problem in the alternator or generator itself.

NOTE: When readjusting a voltage regulator make the adjustments in steps of .3 volts. Larger changes may lead to over or under charging the battery.

Ammeter

The ammeter is used during a tune-up to test the charging systems for correct current output. It may also be used to measure the current draw of any circuit and during certain pinpoint tests of the charging system.

Tune-up tests with the ammeter.

CHARGING CURRENT

This test measures the maximum current the charging system can deliver.

1. **Set the function switch to AMPS.**
2. **Connect the external shunt to the charging system's output terminal. Figure 4.**

NOTE: For positive ground vehicles move the knurled nut to the other end of the shunt and connect as above.

3. **Crank the engine several times without starting to partially discharge the battery.**
4. **Start the engine and run it at about 2000 RPM. Note the highest reading on the ammeter just after starting the engine.**

ACCEPTABLE – Ammeter reading is within 10 amps of rated output specified by the manufacturer.

NEEDS SERVICE – Maximum output is 10 amps or more below the specified output. For DC generators only; needs service if the measured output is above specified output.

CORRECTIVE ACTION – Test alternator or generator output by bypassing the regulators control; see charging system output with regulator bypassed.

DC generators only; If output is too high, readjust the regulator's current limiter or replace the regulator.

Other tests with the ammeter

Charging Current with the regulator bypassed

This test is used to pinpoint the cause of low charging current to either a defective alternator or generator or to a misadjusted or defective regulator. During this test you will briefly bypass the control circuit of the regulator, causing the alternator or generator to produce its maximum output. By analyzing the results you know what component to service.

1. Stop the engine and disconnect the field wire. Figure 9.
2. Connect a jumper wire to the field terminal, being careful not to ground the wire at the connection point or to touch any other terminal. Do not connect the other end at this time.
3. Start the engine and run it at 2000 RPM.
4. Briefly touch the loose end of the jumper wire to ground. Watch the ammeter. If you get a reading refer to the results. If the meter did not read then continue to Step 5. WARNING: DO NOT do Step 5 if you had any reading during Step 4.
5. If no reading was seen during Step 4, touch loose end of the jumper to either the alternator's output terminal or the battery's insulated terminal. Read the ammeter.

CAUTION: Do not leave the jumper lead connected for more than 30 seconds or the battery may be overheated by the high current.

CORRECTIVE ACTION – If the output was acceptable, then the regulator requires readjustment or should be replaced.

If the output was below the specified amount, or 0, then remove and service the alternator.

Technical Note: The above test procedure will test both types of field circuits in use, one where the field circuit is grounded through the regulator, and the other type where the field is grounded in the alternator or generator. This procedure will safely test both types without the possibility of damage to the system or the tester. It is important that you follow this procedure exactly.

Current draw of any circuit

This ammeter may be used to measure the current draw of any circuit by either placing the external shunt in series with the circuit to be tested or by placing it in the vehicle's circuit where it will measure all the current flow from the battery except the starter current draw.

1. Connect the ammeter shunt into the circuit to be tested, or at the point where the battery and charging system output leads are connected.
2. Turn on the accessory to be tested. Do not start the engine. Read the ammeter.

ACCEPTABLE – Ammeter reads within manufacturer's specifications.

NEEDS SERVICE – Reading too high or too low.

CORRECTIVE ACTION – If the current is too high then there is short or ground between the point where you are making the measurement and the point where that circuit is connected to the vehicle's chassis. Depending on the amount of current and the circuit either move the ammeter connection toward the ground connection step by step or use a voltmeter to find the ground.

If the current is too low there is excessive resistance in the circuit. Use the voltmeter function to pinpoint the point of excessive resistance following the instructions in the voltmeter section.

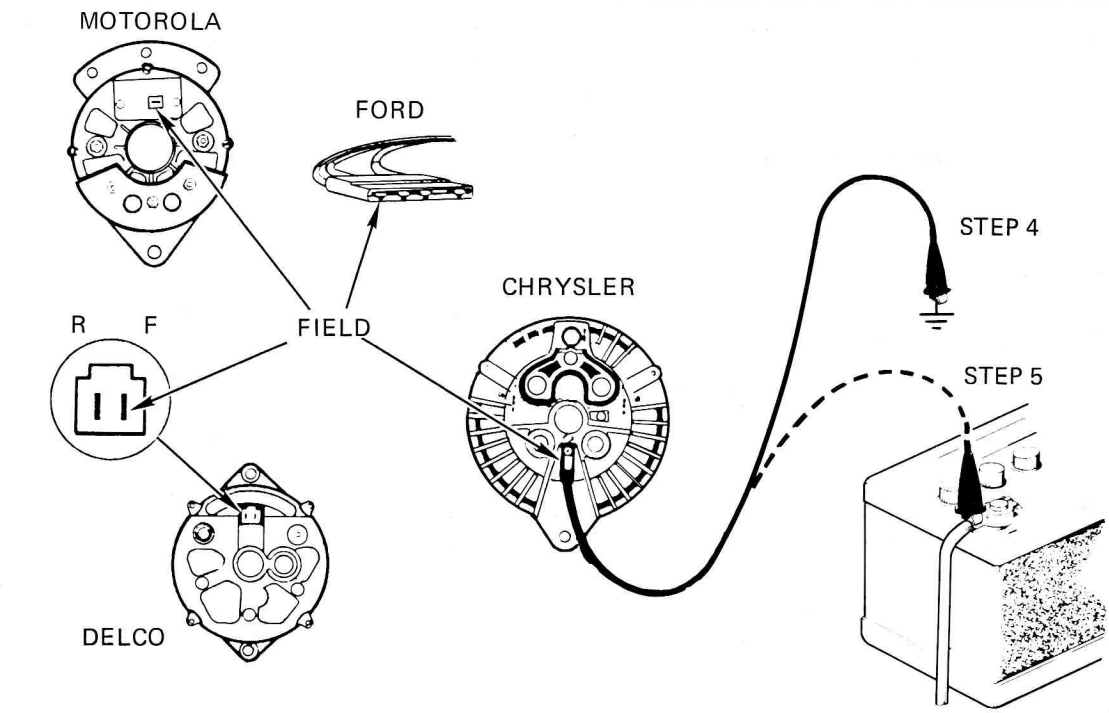


Figure 9

CAR RECORD

Complete the top half of this chart with the information needed for each car you will be tuning up. Take this book with you when you shop for the parts you need as the information is necessary to select the correct parts. The second part of the chart shows what to buy. You can fill in the part number of the items you purchase, so next time your shopping will be easier. Most manufacturers have developed a common numbering system for tune up parts.

Vehicle Description	CAR No. 1	CAR No. 2	CAR No. 3
Make			
Model			
Year			
Engine Displacement			
Air conditioned			
Amount of oil for complete change			
Recommended weight			
Distributor No.			
Chassis Serial No.			
Engine Serial No.			

IMPORTANT TUNE UP SPECIFICATIONS

Cranking Voltage	9.6 (9.0)V	9.6 (9.0)V	9.6 (9.0)V
Charging Voltage	13.3-14.5V	13.3-14.5V	13.3-14.5V
Charging Current	*	*	*
Compression	*	*	*
Dwell	*	*	*
Initial Timing	*	*	*
Idle Speed	*	*	*

*Record from TUNE UP SPECIFICATIONS for your car(s)

	Part Numbers		
PARTS	CAR No. 1	CAR No. 2	CAR No. 3
Spark plugs			
Ignition set			
Distributor cap			
Air filter			
Oil filter			
PCV filter			
Fuel filter			
PCV valve			

Retain original packing materials in case you need to return your instrument. They have been carefully designed to protect it in transit.

As it is impossible for this instruction sheet to cover every make, model and year of production of every automobile made in the world, the user of this piece of test equipment is cautioned as follows: An incorrect hook-up of this piece of test equipment, as its use is not within the control of this company, might cause some detrimental result to the electrical system. Such result is not the responsibility of RAC, and it assumes no liability for it.

TACHOMETERS/GAUGES/TEST EQUIPMENT

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R

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